DIZZINESS DISORDERS AND HEAD TRAUMA

Tallgrass Balance, Hearing & Physical Therapy

Gary McKnight, AuD
Tim Willingham, PT

Difficult Patient Base

- "There is no greater diagnostic challenge in medicine than the accurate diagnosis and effective treatment of the patient experiencing dizziness…it is an extremely complex sensorimotor task."

  Joel A. Goebel, MD

Head Injury

"Any sizeable force that impacts the skull will oscillate the brain, shaking and twisting it. The motion stretches and sometimes tears nerve fibers, cells, and blood vessels. A neurometabolic cascade ensues…the brain undergoes a cellular energy crisis…it suddenly needs more blood but it is getting less…symptoms can be unremarkable and fleeting, an instant of wobbliness, a brief vacant look."

Head Injury

"By then the cells in the medial temporal lobe, the delicate part of the brain most affected, are entering a kind of recuperative hibernation…they can heal themselves…but only if given time to recover. Unfortunately, this area helps modulate emotion, and when these cells wink offline, players struggle with all emotional control."

Robert Cantu, MD

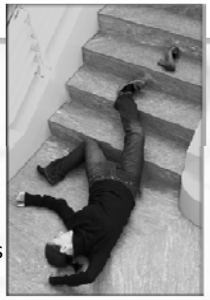
Center for Traumatic

Dizziness

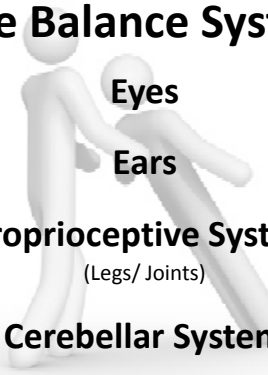
- In Patients **65 & Older**, Number **3** Reason People Visit PCP
- Affects **40%** of Americans **over age 75**
- **Number 1** Complaint in Patients over age 75

Falling

- **65 Year Old Women**
  - -- 1 in 3 will fall with injury
  - -- 30% chance of falling
- **After Age 65**
  - -- Fall Rates **Increase** 13%/ yr
- **Patients 80 & Older Breaking a Hip**
  - -- 50% never return to previous living arrangement
  - -- 50% pass away in 18 months



The Balance System



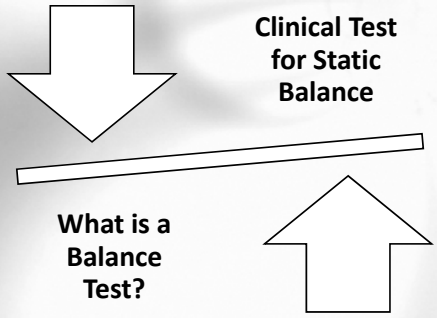
Eyes

Ears

Proprioceptive System
(Legs/ Joints)

Cerebellar System

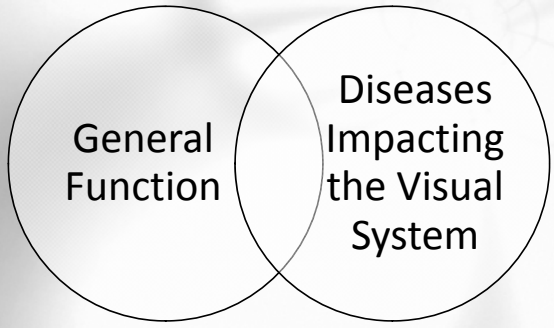
Simple Balance Test



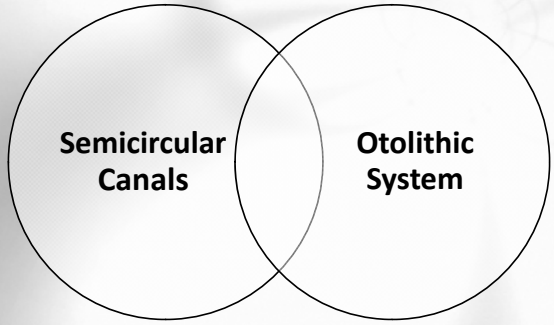
Clinical Test for Static Balance

What is a Balance Test?

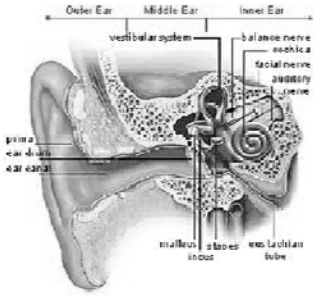
Balance System: Eyes



Balance System: Ears



EAR



Vestibular system

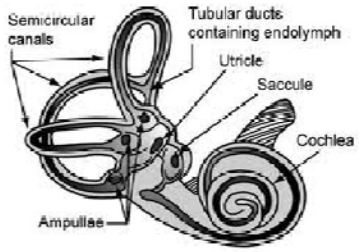
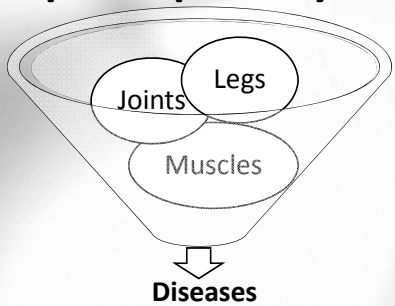


Figure 2: The Vestibular System - semicircular canals and otolith organs

VOR and Smooth Pursuit

- Vestibulo-ocular reflex-keeping the eyes on target when the head is moving
- Smooth Pursuit-keeping the eyes on target when the head is still and the object is moving
- Examples of both systems

Balance System: Proprioceptive System



Proprioception

- Internal awareness of body position
  - Specialized sensory receptors found in muscles, tendons, joints

  - Muscle spindles, Golgi tendon organs, joint receptors
- Kinesethesia- body awareness through motion

EQUILIBRIUM

- Complex function that requires accurate information from three systems:
  - Vestibular
  - Visual
  - Somatosensory
- Central nervous system- integrates the sensory input for motor control response

Vestibular system

- Internal reference
- Tells the brain:
  - how the head is moving
  - direction of movement
  - Acceleration
- It contributes up to 2/3 of the info required for equilibrium

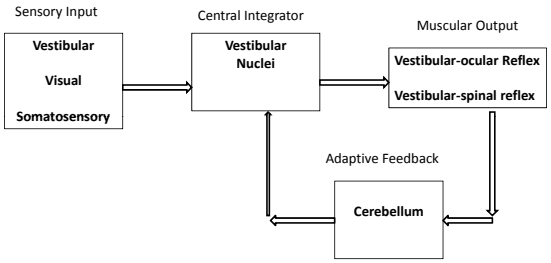
Visual system

- External reference
- Peripheral vision gives info about motion
- It tells us where we are and where we are going

Somatosensory system

- Muscle receptors in lower leg joints and muscles that gives external reference cues to the brain
- Muscle proprioceptors in the neck gives the brain input regarding head position

Equilibrium Schematic



Vestibulo- spinal reflex

- Sends descending motor control signals to the musculosketal system for postural control
  - Mediates postural changes
  - Balance reflex motor actions

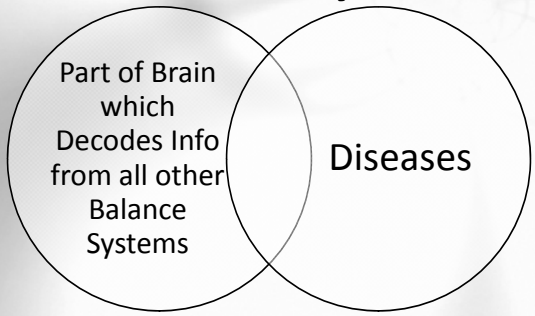
Postural control

- To maintain Center of Gravity over base of support (definition of balance)
- Output: Antigravity muscles
- Ventral: Abdominals, Quads, Tib Anterior
- Dorsal: Paraspinals, Hams, Glut Max, Gastroc

Vestibular Ocular Reflex

- VOR- allows for gaze stabilization
  - Maintaining clear vision during activities where you are actively moving your head and body

Balance System: Cerebellar System



Evaluating the Dizzy Patient

Help your Doctor Help YOU!

Describe Your Symptoms

DO NOT use the word "DIZZY"

Medications & Dizziness

Almost Every Medication in PDR List *Dizziness* as a Potential Side Effect

Common Examples

Diuretics
Aminoglycosides
NSAIDS
Anti-hypertensive drugs
Mood Altering Drugs
Anti-convulsants

Hearing Loss & Dizziness

Hearing Exam is to the Dizzy Patient what an EKG is to the Heart Patient

Many Diseases Causing Dizziness Impact Hearing

Simple, Painless way to Evaluate Important Parts of the Balance System

Multidisciplinary Team

Primary Care Physician

Everyone needs a Quarterback!

Audiology & ENT
Neurology
Cardiology
Physical Therapy
Orthopedics
Optometry/ Ophthamology
General & Vascular Surgery

Vestibular Exams & Systems

Special Tests for the Dizziness & Balance Disorder Patient

Balance Quest	VNG	Rotary Chair
MRI/ MRA & CT	Serologic Studies	

Balance Quest

Computerized Dynamic Posturography

VNG

Video Goggles

Caloric Testing

Rotary Chair

Imaging

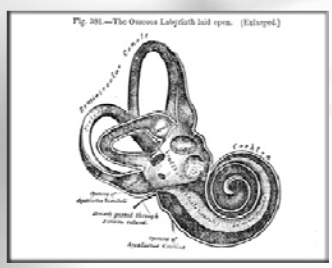
MRI & MRA

CT Scan

COMMON DIZZINESS DISORDERS SECONDARY TO TRAUMA

- Benign Paroxysmal Positional Vertigo
- Cervical Vertigo
- Labyrinthine Concussion
- Temporal Bone Fracture
- Traumatic Meniere's Disease
- Perilymphatic Fistula
- Post-concussive Syndrome
- Cerebellar Hemorrhage

BPPV



Presentation

Causes

Treatment

Treatment of BPPV

- If properly administered over 90% resolution
- Home exercises rarely work
- High incidence of recurrence with trauma
- Variations of canalith repositioning techniques
- Importance of complete evaluation

Cervical Vertigo

- Difficult to diagnose-Diagnosis of exclusion
- Whiplash injury to the neck
- Patient often describes “swimming”
- Dizziness with head-on-body movements
- Referred pain in shoulders and scapular region
- Imaging studies usually normal

Treatment of Cervical Vertigo

- Medicines for pain and inflammation
- Surgical Options
- Physical Therapy Modalities
- Alternative Options

Labyrinthine Concussion

- Trauma can damage the hearing, vestibular, and/or central “connections”
- Damage to the hearing can be transient or permanent, can be isolated regions of the hearing or complete loss
- Many patients experience immediate, high frequency tinnitus in one or both ears
- Dizziness with head movement (frequency not positional)
- Neuroepithelium of the semicircular canals

Treating Labyrinthine Concussion

- Steroid options for hearing loss
- Tinnitus treatment
- Retraining the VOR injury

Temporal Bone Fracture

- Significant trauma required to fracture the hardest bone in the body
- Secondary central damage extremely likely
- Profound-usually permanent-sensorineural hearing loss, on the side of trauma
- Significant vertigo, nausea, and ataxia with third degree horizontal nystagmus beating away from the damaged side

Treating Temporal Bone Fracture

- Imaging Studies
- Bed Rest
- Medications for Nausea
- Steroids for Hearing Loss
- Headache Concerns
- Vestibular Rehabilitation

Meniere's Disease

Fluctuating Hearing Loss

Tinnitus

Aural Pressure

Vertigo

Causes

Treatment

Treating Meniere's Disease

- Dropping sodium to decrease "pressure" issues in the inner ear
- Water intake and low salt diet
- Diuretics
- Supplements
- Injections and Surgery
- Steroids for "hot phases"

Perilymphatic Fistula

- A fistula is defined as "a communication between two areas of the anatomy that should be separated"
- Perilymphatic Fistula is a tear or hole that presents between the inner ear (full of fluid) and the middle ear (should be air-equal pressure to the "outside" world)
- The sudden drop in fluid pressure at the level of the inner ear causes extreme vertigo

Common Symptoms of a Fistula

- Vertigo is constant at onset, typically one to three days
- After some recovery time, vertigo is stimulated with any lifting or straining
- These episodes are brief with a strong sense of rotation
- Rare significant hearing loss, but, high frequency tinnitus is common

Treatment of a Fistula

- Bed rest
- Significant restrictions of weightlifting, cycling, etc.
- Surgical Repair-approach through the ear canal-lift the eardrum out of the way-apply chemical looking for reaction-graft area-pray for a miracle

Three Clinical Conditions

- Patients who are conscious or rapidly regaining consciousness (minor head injury)
- Patients who have been comatose from the time of head injury
- Concussion Followed by a lucid interval and serious cerebral damage

Postconcussion Syndrome

- Headache (general or localized)-aggravated with stress or exertion-improved with rest
- Dizziness-usually not vertigo but giddiness or lightheadedness, unsteady, dazed, weak, or faint
- Typically clears within weeks, sometimes months
- Constitution of the patient seems to very important (active and fit versus anxious)

Cerebellar Hemorrhage

- Progresses over minutes to hours
- Vomiting
- Occipital headache
- Vertigo
- Ataxia
- Ipsilateral facial weakness
- Blepharospasm
- Involuntary closure of one eye

Role of Physical Therapy

Balance Retraining

Fall Prevention

Vestibular Rehabilitation Therapy

PT: Balance Retraining

- Anticipatory Balance
  - Anticipate how one might lose balance and make proper body adjustments
    - Static wobble-type devices

PT: Balance Retraining

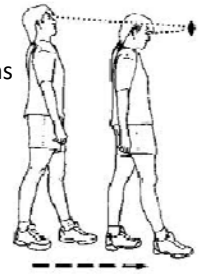
- Reactive balance- body's neuromuscular response or reaction when an external stimulus displaces COM alignment.

Fall Prevention

- Elderly fallers
  - Employing strategies to avoid situations where one could fall
    - Night lights, no throw rugs

Vestibular Rehab Therapy

- VRT- series of head and eye exercises given under both static and dynamic conditions



VRT: Goals & Objectives

- Extinguish or diminish motion or posturally provoked symptoms.
- Enhance equilibrium
- Increase quality of life by increasing activity

VRT (continued)

- Adaptation-exercises which extinguish symptoms through repetition of provoking type exercises
  - Improve VOR
- Substitution-strengthens weakened system to return to function by challenging remaining ones
- Combination

Neurocom VSR Sport

- Portable balance assessment system for athletes with pre- and post- concussion.

Our Research In Treatment

Therapy Must be Focused & Targeted

Establish Specific Treatment Goals

Objective Measurements of Pre/ Post Therapy

Thank you.